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ABSTRACT

This report, concerned with an equitable procedure to determine student financial aid eligibility, argues for adoption of an annuity income measure of parents' ability to pay, and against continuation of the consensus measure developed by the Keppel Task Force--National Task Force on Student Aid Problems (the UM measure). The new Uniform Methodology (UM) measure could be implemented in two stages. In the first stage, four changes to the UM measure would be introduced. None of these changes would require the collection or analysis of additional data; they should be introduced as a package. In the second stage, the UM should be made more comprehensive by expanding the list of assets included in the resource base. The values of many of these assets will have to be estimated by calculating the discounted present value of current and projected future income from each asset. In addition, the allowances against income--living, tax, retirement--should be converted to a negative asset value by calculating the discounted present value of current and projected future allowances. Only after both stages have been implemented will the annuity income approach be complete, internally consistent, and equitable. (Author/RL)

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ACT SPECIAL REPORT TWENTY-ONE

An Economist's View of the Uniform Methodology

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The chief beneficiaries of ACT's services are students, secondary schools, institutions of postsecondary education, and educational researchers.

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FOREWORD

The American College Testing Program (ACT) has been actively and heavily involved in the student financial aid process for over ten years. A major part of this activity has been the provision of a Student Need Analysis Service for financial aid applicants and postsecondary institutions and agencies. The development of an acceptable, rational, and equitable underlying need analysis model has been a major part of ACT's efforts in the Student Need Analysis Service.

Major cooperative effort on the part of involved agencies and organizations was stimulated by the National Task Force on Student Financial Aid Problems, and has resulted in a Uniform Methodology currently being used by the two major need analysis services. Implementation of the Uniform Methodology represents a major step forward in the consistent assessment of financial need for most applicants seeking institutional, state, and campus based financial aid funds.

The Uniform Methodology was conceived in the spirit of compromise and continues to be revised in the same spirit. Most would agree that it does not represent the ultimate in terms of a need analysis model. Indeed, the current model necessarily reflects many political and pragmatic considerations. These are real, and have to be basic considerations in the development of any need analysis model.

However, it is important to continue to examine the broader issues of need analysis while dealing with the day-to-day pragmatic scheme of things. It is in this spirit that this paper is presented. ACT does not necessarily endorse either particular resolutions of issues as discussed, or the approach in general. We do feel it is important to continually keep a broad perspective on this significant issue, lest we relinquish our search for a more perfect implementation of the goal, or settle on a mechanism and lose sight of its purpose.

This paper arose from consulting support Dr. Barnes has given to ACT as part of its efforts to contribute to the revision of the Uniform Methodology over the past few months. ACT hopes it will help stimulate thought and discussion concerning the general issue and alternative approaches.

Joe B. Henry
Program Vice President
Division of Student Assistance Programs
The American College Testing Program

INTRODUCTION

Need analysis is a procedure employed by student financial aid administrators to determine the eligibility of postsecondary students for scholarships, grants, work-study jobs, and loans. The steps involved in executing this procedure are conceptually simple and straightforward. First, the cost to a student of attending the postsecondary institution of his or her choice is determined by a financial aid administrator at the institution. Second, the combined ability of a family and student to contribute to these costs is determined by an outside need analysis service such as the American College Testing Program (ACT), the College Scholarship Service (CSS), or one of the state or federal agencies involved in making aid awards to students. Third, the student's financial need is calculated by subtracting the expected contribution of the family and student from the costs of school attendance. Finally, the aid administrator at the institution provides the student with an aid package intended to meet financial need. The package may consist of any combination of grant, scholarship, job, and/or loan, providing that the aid administrator adheres to legal constraints imposed by government programs, and providing that the total amount of such aid does not exceed the student's financial need minus any aid received from noninstitutional sources.

The offer of aid actually received by a student depends on many factors other than the ability of the family unit to meet educational costs. For example, it depends on the amount and type of resources available to the institution's aid office; on the way in which the aid administrator calculates student budgets; and perhaps most importantly, on the way in which aid awards are packaged by the aid administrator.

Over the past two decades student financial aid administrators have made significant progress in standardizing aid award practices. They now generally calculate student budgets in a similar way, and apply for all government funds for which their students are eligible. Recently, they have urged the adoption of a common approach to aid awards, called equity packaging.[1]

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[1]This approach was recommended by the Keppel Task Force in the *Draft Final Report of the National Task Force on Student Aid Problems* (Brookdale, California: 1975). See pages 68-78. The equity packaging approach has not yet been completely accepted by the student aid community.

Perhaps the most successful move towards standardization has been the formal adoption of a consensus model for determining the expected contribution of a student and his or her family. This model, formally called the Uniform Methodology, was first developed and presented by the National Task Force on Student Aid Problems (The Keppel Task Force) in its Draft Final Report. The Uniform Methodology was first implemented by ACT and CSS for the 1976-77 academic year.

Since the stated purpose of need analysis is to equalize access to postsecondary education, modern need analysis attempts to equalize the financial burdens borne by postsecondary students and their families. Emphasis is placed on achieving equity. This means that those with equal ability to pay should receive equal offers of aid, and, conversely, that those with unequal abilities to pay should receive unequal aid offers.

The purpose of this report is to evaluate the Uniform Methodology (hereafter abbreviated UM) from an economist's perspective. It is shown that, like the earlier models upon which it is based, the UM model fails to treat assets and income in a proper and consistent manner. This results in hidden inequities favoring parents who are homeowners, well educated, widowed, and divorced, and who do not own wealth in conventional forms such as stocks, bonds, bank accounts, or real estate. This report argues for the adoption of an annuity income measure of parents' ability to pay as the best way to eliminate inequities, inconsistencies, and hazards from the determination of need.

In order to justify the recommendation of an alternative approach to need analysis, it is necessary to review the theoretical link between income and wealth. The report begins with this undertaking. It then compares the UM model with a more equitable model. On the basis of this comparison, the report recommends a series of modifications to the current version of the UM model. Some of these modifications are simple and can be implemented immediately without the collection of additional data. Some, however, are more involved, and would require further analysis and/or the collection of additional data. It is shown that if all recommendations were adopted, the new approach would bear a striking resemblance to the Present Value of Total Resources approach once recommended by the Cartter Panel.[2]

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[2]A. M. Cartter (Chairman), *New Approaches to Student Financial Aid: Report of the Panel on Student Financial Need Analysis* (New York: College Entrance Examination Board, 1971).

THE RELATIONSHIP BETWEEN INCOME AND WEALTH

Stocks vs. Flows

Economists generally use one of two alternative approaches when measuring ability to pay. One approach is to determine the market value of an individual's wealth. This value represents the individual's total command over goods and services in the marketplace at a particular point in time. Such a measure is called a stock.

Another approach is to sum all sources of income for an individual over a period of time. This value represents the change in the individual's total command over goods and services in the marketplace over that same period of time. Such a measure is called a flow.

These approaches are not mutually exclusive, because the flow of income during a particular time period is equal to the change in value of wealth (stock) over that same period. The change in value may take the form of a capital gain (or loss), or of direct cash payments to the owner(s) of wealth, or both.[3] Income is increased even when capital gains are not actually realized through the sale of assets, because the purchasing power of the wealthholder is increased by the amount of the capital gain. Thus, an individual's total income during a particular time period is equal to the sum of capital gains (or losses) and direct payments earned on assets.

The relationship between income and wealth is subject to two important generalizations. First, all income payments—whether in the form of wages and salaries, interest, dividends, rents, profits, alimony, insurance payments, or transfer payments from government—can be viewed as a return to some form of wealth. Conversely, all wealth—whether in the form of tangible or intangible assets—yields income. Second, in the long run, the amount of income yielded per dollar of wealth will tend to be the same regardless of the form in which wealth is held.

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[3]In some cases, payments may be in the form of goods and services. Payments in this form may be viewed as income-in-kind.

The First Generalization

The validity of the first generalization may be demonstrated by referring to Table 1. The first column presents a list of fourteen types of income received by households. The second column contains the wealth items which yield these types of income. The list of income and assets is more exhaustive than that used in the UM's current measure of ability to pay. A brief discussion of the income and asset items in Table 1 may be helpful to readers unfamiliar with this approach.

Item 1 refers to all labor income—whether it is in the form of wages, salaries, overtime payments, fringe benefits, or tips. All labor income may be viewed as a return to a form of wealth which economists call human capital: the value of an individual's past investments in education, health care, job search, on-the-job training, and any other activities that affect labor productivity. The value of human capital must be estimated because no market for its exchange exists. (Such a market would require resurrecting the institution of slavery.) The estimated value of human capital is given by the discounted present value of an individual's expected earnings over the years.[4] Conceptually, the present value of lifetime earnings is equal to the amount that an individual could receive now if she sold to another an entitlement to receive all her future labor income.

Items 2, 3, 4, 5, and 6 (interest, dividends, profits, rents, and royalties) are familiar to financial aid administrators. However, capital gains on these assets represent the yearly change in their value whether or not these gains (or losses) are actually realized.

The assets which provide income under items 7, 8, and 9 (life insurance, annuities, alimony, and transfer payments) are not actually traded on any organized market; yet they are forms of wealth with unique present values. For example, consider a widow who is entitled to receive $1,000/year until her eighteen-year-old child reaches the age of twenty-two, and then a lump sum payment of $10,000. These payments could be the combined result of life insurance and social security benefits. The stream of payments which the widow receives represents her legal entitlement to such funds, under the terms set forth in the life insurance policy of the deceased husband, and in the existing social security regulations and statutes. The market value of her entitlement to the stream of payments in question is the same as the market value of a riskless bond paying $1,000 per year for four years and then $10,000 at the end of the fourth year when it matures.

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[4]The method and rationale for estimating the discounted present value of expected lifetime earnings is summarized in Appendix C.

TABLE 1

Flow and Stock Measures of Total Resources

	FLOW (Income)		STOCK (Assets)
1.	Wages, salaries, tips, other employee compensation	1.	Present value of lifetime earnings
2.	Interest income plus capital gains	2.	Market value of credit instruments such as savings accounts, notes, bonds, CD's, or mortgages
3.	Dividends plus capital gains	3.	Market value of stocks, mutual funds, warrants, options, or futures
4.	Profits from farm or business plus capital gains	4.	Equity in farm or business
5.	Net rental income from real estate holdings plus capital gains	5.	Market value of real estate holdings
6.	Royalties plus capital gains	6.	Market value of patents, copyrights, or oil leases
7.	Income from life insurance, annuities, and estates	7.	Present value of income from life insurance, annuities, and estates
8.	Alimony and child support	8.	Present value of current and future alimony and child support payments
9.	Transfer payments from government, business, private sector	9.	Present value of transfer payments from government, business, private sector
10.	Interest and dividends paid on the cash value of whole life insurance, endowment, and retirement policies, pension funds, and annuities	10.	Cash value on whole life insurance, endowment, and retirement policies, pension funds, and annuities
11.	Earnings on trust fund assets plus capital gains	11.	Market value of trust fund assets
12.	Income and capital gains from other assets	12.	Market value of jewels, gold, silver, other precious metals, gems, rare collections, works of art, club membership stocks, or antiques
13.	Imputed value of owner-occupied housing	13.	Home equity
14.	Imputed value of services from consumer durables	14.	Equity value of consumer durable goods

An entitlement to receive income payments in the future from sources such as life insurance, an annuity, an estate, a divorce agreement providing for the payment of alimony and child support, or from some government program, is a form of wealth which is similar to a bond. Both forms of wealth are contractual entitlements with a finite life. There are, however, important differences between these two forms of wealth.

Bonds have clearly stated maturities; the time when income payments from sources 7, 8, and 9 will stop is not always known. Bonds generally pay a fixed amount over the life of the bond; income payments from sources 7, 8, and 9 may vary in frequency and amount. Bonds may be legally traded; entitlements providing income in the form of 7, 8, and 9 may not be traded.

Despite these differences, any entitlement to future income payments can be converted to a single value in exactly the same way that future labor income can be converted to a single value. This value represents the payment that one would receive if one were able to transfer title to the stream of income payments in items 7, 8, and 9. These values are given by asset items 7, 8, and 9.

Income and asset items 10, 11, and 12 (interest, dividends, earnings, and capital gains on policies, annuities, trusts, and other assets) are self-explanatory. In the case of items 11 and 12 (trusts and other assets), unrealized capital gains are often important.

Houses, cars, appliances, furnishings, and other consumer durables are assets (items 13 and 14) which yield a flow of services to their owners. If consumer durables were rented out by the owners to other users, their services would command a dollar payment in the marketplace. The rental value of services from consumer durables is used to impute a value to the income-in-kind received from wealth held in the form of consumer durables. In cases where some indebtedness against consumer durables is outstanding, the imputed income is given by the rental value of the *equity* in the consumer durables. Therefore, in the case of asset items 13 and 14, the income flows are given by imputed values based on owner equity in houses and other consumer durables.

The purpose of the preceding discussion of the income and asset items in Table 1 has been to establish the validity of the first generalization about the relationship between income and wealth: that all income may be viewed as a return to some form of wealth, and all wealth may be viewed as the source of some type of income. We turn now to a discussion of the second generalization about the relationship between income and wealth: that in the long run the amount of income yielded per dollar of wealth tends to be the same regardless of the form in which wealth is held.

The Second Generalization

To establish the validity of this generalization, it is useful to determine that an individual would choose to hold wealth in a form which did not carry the highest possible yield only if he were compensated for accepting a lower yield or penalized for claiming a higher yield. For example, an individual will choose a municipal bond yielding 5 percent over a corporate bond (of equal maturity and risk) yielding 9 percent if the value of the tax exemption on municipal bond interest payments is enough to raise the after-tax yield on the municipal bond to 9 percent or more. Similarly, an individual will choose a 90-day treasury bill paying 5 percent over a corporate bond paying 9 percent if the cost of the reduced liquidity and increased risk of the corporate bond is enough to lower the true yield of the corporate bond to 5 percent or less. In general, differences in the nominal yields on wealth are due to differences in tax treatment, liquidity, risk, term to maturity, negotiability, or marketability of assets. The "true" yields should be equal.

To see this, imagine that investors could choose between two forms of wealth with identical characteristics but different yields. Suppose asset *A* cost $1,000.00 and paid $50.00 per year, and asset *B* cost $1,000.00 and paid $100.00 per year. Such a situation would be untenable, because wealth holders would attempt to sell asset *A* and buy asset *B*. This would continue until the price of *A* had fallen enough, and the price of *B* had risen enough, to equalize the yields on *A* and *B*. The final prices for *A* and *B* might be $625.00 and $1,250.00, respectively. Their common yields would be 8 percent (50/625 = 100/1250 = .08).

This example suggests that when yields on nearly identical assets get out of line in the short run, their prices will adjust to reestablish equality of yield. Thus, changes in yield are reflected in the market values of wealth, and changes in the market values of wealth insure that the "true" or adjusted yield on wealth is the same regardless of the form in which wealth is held. This demonstrates the validity of the second generalization.

The Income–Wealth Equations

The two generalizations concerning the relationship between income and wealth may be formalized in the following equation:

$$Y_i = r \cdot W_i \qquad i = 1, 2, \ldots, 14 \qquad (1)$$

Equation (1) states that the income derived from holding wealth in form *i* is given by the product of the common rate of return on wealth, *r*, and the

market value of wealth held in form i. Y_i may be viewed as the permanent income that would result if wealth in the form of asset i were maintained at its present level. The rate of return, r, is generally taken to be the rate on long term, fully taxable, negotiable, marketable, government bonds (or top rated corporate bonds).

Equation (1) suggests that a proper measure of parents' ability to pay would either be total wealth or total permanent income, but not both. The relationship between total wealth and total permanent income is given by equation (2) below:

$$\sum_{i=1}^{14} Y_i = r \cdot \sum_{i=1}^{14} W_i \qquad (2)$$

Any measure which included both total wealth and total permanent income would be redundant and clumsy. It would be equivalent to measuring distance in both feet and inches.

In a sense total wealth and total permanent income are timeless measures, because the former exists at a point in time, but the latter exists in perpetuity. Thus, if a forty-year-old head of household had the same total wealth as a sixty-year-old head of household, both would be judged equal in their ability to pay for college. But the sixty-year-old head of household would have a shorter period of time (in an actuarial sense) over which to liquidate her wealth than would the forty-year-old head of household. That is, if both individuals were able to sell all of their wealth (including human wealth), and use the proceeds to buy an annuity payable until death, the sixty-year-old head of household would be better off than the forty-year-old head of household because the expected number of remaining years until death would be lower for the former than for the latter. This suggests that an alternative, and perhaps preferable, measure of ability to pay would be the annuity income that each would receive if total wealth were converted to a constant annual income flow over the n years remaining in the expected lifetime of the head of household. Such a measure may be expressed formally as the left side of equation (3).[6]

$$\sum_{i=1}^{14} Y_i = A_n \cdot \sum_{i=1}^{14} W_i \qquad (3)$$

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[5]The concept of permanent income as a measure of purchasing power was introduced by Milton Friedman in *A Theory of the Consumption Function* (Princeton: Princeton University Press, 1957).

[6]This approach was first recommended by B. A. Weisbrod and W. L. Hansen in "An Income-Net Worth Approach to Measuring Economic Welfare," *The American Economic Review* 58 (1968), 1315-1329.

To distinguish it from the permanent income measure given in equation (2), let us call it an annuity income measure. The term A_n is the n period annuity income per dollar of wealth sold. A_n is greater than r because it includes some consumed wealth in addition to the rate of return on wealth. The exact value of A_n varies inversely with n and directly with r. It is given by the expression[7]

$$A_n = r[1-(1+r)^{-n}]^{-1} \qquad (4)$$

In terms of the concepts of need analysis, A_n may be viewed as the analogue of the asset conversion rate now used by the UM to convert Discretionary Net Worth to an income supplement (see Appendix B for the derivation of A_n). A_n is different from the asset conversion rate in that it varies among families, depending upon the expected remaining lifetime of the primary earner. This means that younger parents would have a dollar of Net Available Assets converted to an income flow at a lower rate than would older parents. This is a consequence of our assumption that wealth is to be viewed as stored-up purchasing power to be used in later years.

Table 2 presents illustrative values for A_n for different combinations of values of n and r. The majority of parents with college age children are probably between the ages of 35 and 55 when their children go to college. If their average expected lifespan is 70 years, then n would vary between 15 and 35 years.

TABLE 2

Illustrative Values for A_n

n (Years)

r (%)	15	25	35
7.5	.1133	.0897	.0815
8.5	.1204	.0977	.0902
9.5	.1277	.1059	.0992

[7]The derivation of equation 4 is given on page 24 of W. J. Goggin, *The Measurement of Economic Well-Being in Need Analysis Models*, ACT Research Report No. 66 (Iowa City, Iowa: The American College Testing Program, 1974).

For rates of return between 7.5 and 9.5 percent, Table 2 shows that A_n would range between 8 and 13 percent. For most families, A_n would be lower than the current asset conversion rate. Thus, if everything else were equal, their expected contribution from assets would fall below its present level if the asset conversion rate were set equal to A_n.

COMPARISONS OF ANNUITY INCOME AND OTHER APPROACHES TO NEED ANALYSIS

The Choice between Annuity Income and Permanent Income

The entries in Table 2 suggest that if annuity income were used as the measure of ability to pay in need analysis, the contribution from a dollar of wealth would increase with the age of the parents. This result might at first seem to discriminate against older parents, and therefore to argue in favor of the adoption of a permanent income measure instead of the annuity income measure. The question which naturally arises, then, is whether the "discriminatory" effect can be rationalized on theoretical grounds.

To answer this question it is first necessary to understand the basic difference between the two measures. In the annuity income measure, it is implicitly assumed that wealth is to be consumed gradually over the n years in which payments are made. Thus, if the wealthholder lives the expected number of years n, and then dies, the value of his or her bequest to heirs will be zero. In the permanent income measure, however, the value of a bequest would be the same as the present value of his or her total wealth today. This follows from the fact that permanent income is paid in perpetuity, while total wealth is maintained at its present level. It appears, therefore, that the choice between annuity income and permanent income depends upon an implicit assumption about the desirability of including an inheritance allowance in the ability to pay calculation.

The choice is complicated by the fact that some individuals will live longer than the expected number of years n, and thus the calculated value of A_n will be too large for them. Hence the annuity income measure will overstate their true yearly purchasing power. In other words, if these individuals were to spend, each year until death, an amount equal to their measured annuity income, they would be in debt when they died, and would leave negative bequests.

The fact that some individuals will live longer than their actuarial lifespan is not necessarily an argument against using an annuity income measure; rather, it is an argument in favor of setting n at a value greater than the

actuarial lifespan. One compromise might be to choose n as the expected number of years until 99 percent of those in a particular age group would be dead. Such a compromise would result in a general reduction in the values of A_n in Table 2, and it would result in a narrowing of the difference between individual entries. However, the values of A_n would, of course, still exceed r—in equation (2)— and would still increase slightly with the age of the parents.

It is conceivable that even this compromise would be unacceptable, because it does not explicitly allow for an inheritance allowance for all persons. The annuity income measure could be modified to include any inheritance allowance which is less than the present value of the parents' total wealth. If it were equal to the present value of parents' total wealth, it would be tantamount to choosing a permanent income measure.

The inclusion of an inheritance allowance, however, seems inconsistent with past practice in need analysis. Therefore, it is reasonable to assume that the choice between a permanent income measure and an annuity income measure would favor a modified version of the latter. Thus, the discussion which follows compares the UM measure of ability to pay with an annuity income measure.

A Comparison of the Uniform Methodology Approach with the Annuity Income Approach

The UM's measure of ability to pay includes the actual income of parents adjusted for nondiscretionary expenditures (called Available Income) and an income supplement from wealth. (See Appendix A for a summary of the UM.) The income supplement is the product of the asset conversion rate and Discretionary Net Worth. The sum of these two income measures yields the financial base (called Adjusted Available Income) from which the expected parental contribution is calculated.

The annuity income approach is superior to this approach because it is easier to administer, more comprehensive, more stable and more equitable. It is easier to administer because it does not require data on both actual income and the market value of wealth. It requires data on actual income only when the market value of some form of wealth must be estimated. This happens in the case of asset items 1, 7, 8, and 9 in Table 1 (wages, insurance and annuity income, alimony, and transfer payments). Otherwise, data on actual income are not needed.

The annuity income approach is more comprehensive than the UM approach, because it reflects realized and unrealized capital gains for the measurement year, whether or not an asset is actually sold. The actual

income data now used in the UM measure include realized gains only. These gains may cover a period longer or shorter than the one-year period involved in measuring parents' current ability to pay. Thus, the true capital gain during the year may be overstated or understated, even when data on realized capital gains are available.

The annuity income approach is more stable than the UM approach, because annuity income is inherently less volatile than actual income. Actual income is subject to random, cyclical and seasonal variation not present in the annuity income measure.

Finally, the annuity income approach is more equitable than the UM approach because it treats all forms of wealth alike—something the UM approach fails to do. To see this, refer to Table 3, where the fourteen forms of wealth listed in Table 1 are sorted into five groups according to the way they are represented in the UM's measure of ability to pay. For example, Group 1 includes all forms of wealth that are ignored by the present UM measure. Group 2 includes all forms of wealth that are represented in the present UM measure only in the form of the actual income from wealth. Group 3 includes all forms of wealth that are represented in the present UM measure only in the form of an income supplement from wealth. Group 4 includes business and farm assets which are included in the present UM measure both in the form of an adjusted income supplement from wealth and in the form of actual income. Finally, Group 5 includes all forms of wealth which are represented in the present UM measure both in the form of an income supplement from wealth and in the form of actual income.

Table 3 shows, for example, that wealth item 10—the cash value of whole life insurance, endowment, and retirement policies, pension funds and annuities—is not included in the UM measure. Similarly, it shows that wealth item 2—the market value of credit instruments—is represented in the form of actual interest income from these assets *and* in the form of the income supplement from these assets.

Wealth held in the form of equity in a farm or business is included in the form of the actual net income of the farm and business and in the form of a subnormal income supplement. It is subnormal because only a fraction of farm and business assets is exempted from coverage. The fraction decreases as the value of farm and business assets increases; but preferential treatment of farm and business assets is not justifiable in terms of purely economic considerations.

The fact that a dollar of wealth is treated differently depending upon its form means that parents with equal total wealth, but different compositions of wealth, will be treated differently. This violates the principle of horizontal equity espoused by all need analysis models.

TABLE 3

The Status of 14 Wealth Items in the Uniform Methodology's Measure of Ability to Pay

Group	Wealth Items	How Represented in the UM Measure
1	10, 11, 12, 14 (Earnings on policies and annuities, trust funds, and consumer durables)	Not included
2	1, 6, 7, 8, 9 (Wages, royalties, insurance and annuity income, alimony, and transfer payments)	Included as actual income only
3	13 (Imputed value of owner-occupied housing)	Included as income supplement only
4	4 (Profits from farm or business)	Included as actual income plus a fraction of normal income supplement
5	2, 3, 5 (Interest, dividends, rents)	Included as actual income *and* as an income supplement

If need analysis is viewed as a system for taxing parental wealth, then Table 3 suggests that the implicit tax rate on wealth increases as one moves from Group 1 to Group 5. In concrete terms, this means, for example, that parents who hold most of their wealth in the form of credit instruments, savings and checking accounts, stocks, mutual funds, or real estate (wealth items 2, 3, and 5) are the *least* favored of all applicants in the need analysis process. Next on the list of the least favored are those holding most of their wealth in the form of equity in a farm or business. Homeowners are favored over renters. Parents having substantial wealth in the form of human capital—well-educated professionals and managers—are favored over parents holding most of their wealth in other forms. In the most favored group are those who hold wealth in the form of asset items 10, 11, 12, and 14 (policies, annuities, trust funds, other assets, and consumer durables) because these assets escape taxation altogether. Finally, widows who hold wealth in the form of assets 7 and 9 (insurance,

annuities, estates, and transfer payments), and divorced parents who hold wealth in the form of asset item 8 (alimony and child support) are favored over those who hold wealth in a form included in Groups 4 and 5 (real estate, farm, or business).

We conclude, therefore, that the UM measure of ability to pay deviates substantially from the model recommended by economic theory. We turn now to a consideration of changes in the UM measure which would move it closer to the annuity income model.

REFORMING THE UNIFORM METHODOLOGY'S MEASURE OF ABILITY TO PAY

In order to implement an annuity income measure of ability to pay, it would be necessary to estimate the value of wealth held in the form of asset items 1, 6, 7, 8, 9, 10, 11, 12, and 14, and to respecify the asset conversion rate along the lines discussed earlier. In addition, it would be necessary to drop actual income from the measure of ability to pay and to include farm and business assets at their full value. An overhaul of this dimension is not, however, likely to occur now or in the immediate future, because new data would be required and because political pressures would resist such major changes. It makes sense, therefore, to classify recommendations for reforming the UM model into those which can be implemented quickly without requiring further analysis and the collection of additional data, and those which can be implemented gradually only after further analysis and provisions for collecting additional data have been completed.

Short-term Reforms

In the short term, the UM model can be modified to improve equity by implementing the following changes:

1. Use an asset conversion rate given by A_n
2. Include equity in farm and business at its full market value
3. Exclude all actual income except labor income from the measure of ability to pay
4. Impute labor income for farmers and businessmen

The first recommendation would require that each need analysis service estimate n for each family and r for each processing year. The value of n could be determined with a high degree of actuarial precision once the criteria for choosing n are agreed upon by leaders in the financial aid

community. The value of *r* should be set equal to the rate of return on long-term federal government bonds having a term to maturity of *n* years. This rate is fairly stable, generally ranging between 7 and 8 percent.

The second recommendation reflects the fact that income from a dollar of wealth held in the form of farm or business equity is no different in quantity or quality than income from a dollar of wealth held in any other form. It should not be given special treatment. This conclusion is not unique. It has been reached by both the Keppel Task Force and by the Cartter Panel. Defenders of the present treatment of farm and business assets argue that these assets are special because the family's livelihood depends upon them. But this is spurious reasoning, because the same can be said of every asset the family owns. The only thing unique about farm and business assets is that they are combined with the human capital of the parent(s) and partner(s) to generate earnings and profits for the owners. This makes business and farm assets a little riskier than others, such as bank deposits, but it does not justify preferential assessment.

The risk involved in owning business and farm assets is a result of the inherent instability in income from this source. But income instability can be overcome if capital markets allow owners of farms and businesses to borrow in bad times. Perhaps no other group in the economy has such free access to credit (often subsidized) as farmers and small businessmen. Thus, it would seem that risk caused by income instability is not a sufficient justification of preferential assessment of farm and business assets.

The third recommendation eliminates the double taxation of wealth held in the form of asset items 2, 3, 4, and 5 (interest, dividends, farm or business profits, rents, and capital gains). However, this recommendation creates one problem. The problem arises because profits from farm and business often include income from wealth held in the form of land, buildings and equipment *and* income from human capital: most farmers and businessmen do not pay themselves salaries that reflect the true value of their labor. Since annuity income from the equity in the farm or business only reflects income from land, buildings, and equipment, it is necessary to estimate labor income. This is the reason for the fourth recommendation.

To impute labor income for farmers and businessmen, it is necessary to subtract the income generated by the owner's share of the physical capital of the farm or business from his total farm or business income (which includes his labor income). The income produced by his share in the business could be estimated as the product of the rate of return on top-rated corporate bonds and the value of the owner's equity in the farm and business. In the event that the imputed labor income is too low, it should

be replaced by a minimum labor income given by the product of the minimum wage and the length (in hours) of the average work year.

These recommended reforms are desirable but incomplete. Only when the UM model has been restructured to include all forms of wealth listed in Table 1 will it be complete and equitable. The discussion moves, therefore, to a consideration of the issues involved in completing the reform of the UM measure of ability to pay.

Long-term Reforms

To complete the reform of the UM measure of ability to pay, it is necessary to include the value of all assets in Table 1 which are presently excluded from the UM measure of ability to pay. Specifically this will require that:

1. Asset items 6, 10, 11, 12, and 14 (royalties, capital gains, earnings on policies, annuities, trusts, and other assets, and consumer durables) be included at their present market values

2. The discounted present value of current and future income from assets 1, 7, 8, and 9 (wages, insurance and annuities, alimony, and transfer payments) be estimated according to the procedure described in Appendix C

3. Income averaging be used to calculate the normal income from assets 1, 7, 8, and 9 in order to improve the precision of the calculated discounted present values

The first two recommendations insure that the ability to pay measure is comprehensive, and hence equitable. If parents are honest in reporting market values, the first recommendation poses no special implementation problems other than the obvious one of providing for the collection of the additional data. The question of honest reporting by parents is considered on pages 19-20.

The second recommendation provides a means of determining the value of wealth when no organized market for its exchange exists. The details of the calculations are shown in Appendix C. The data inputs into the calculation include:

1. The expected length of time that income receipts from wealth will last

2. The rate of interest on a bond of equal risk and duration

3. The size of expected future income receipts

4. The amount of income currently received from wealth

At first, one may imagine that these data requirements are excessive, and probably prohibitive. However, in most cases suitable approximations exist.

In the case of the first data input, parents should be asked how long they expect to continue receiving income from each form of wealth, unless the time period can be reasonably guessed by the need analysis service. For example, one may assume that earnings will continue until retirement unless a parent is disabled. Thus, the age and disability status of the parent should be sufficient to estimate the period before retirement. The length of time that a parent expects to continue receiving life insurance payments, alimony or child support, and transfer payments such as food stamps must be estimated by the parent.

In the case of the second data input, the rate of interest can be determined once the expected duration of income is known, and once a measure of risk is fixed. The measure of risk will, of course, be arbitrary. Since income from assets 1, 8, and 9 (wages, alimony, and transfer payments) is inherently risky, then one might wish to use the interest rate on Standard and Poor's lowest grade bonds in the discount factor. Income from life insurance, annuities, and estates (asset 7) is relatively riskless. Therefore, the rate of interest used to discount these income receipts should be based on the rate for top grade corporate bonds.

In the case of the third data input—expected future income receipts—the approximation becomes less precise. Surprisingly, future earnings may be easily projected by using census data on the average earnings of individuals cross-classified by race, age, sex, occupation, and level of current earnings. In most cases these census averages will be quite satisfactory. The difficulty arises when estimates of future alimony and child support payments, or future transfer payments, are sought. The simplest solution may be to assume that these payments will continue at their present level.

In the case of the fourth data input—current income from each form of wealth—it is perhaps better to use a three-year average of current and past income. This will require collecting additional data, but the gain in precision is likely to be substantial because annual income from assets 1, 7, 8, and 9 is often unstable. For example, child support payments may be temporarily interrupted; earnings may fall during a period of work slowdown; transfer payments may be irregular; or payments from an estate may vary with stock market prices.

The use of income averaging to measure normal income is, of course, the third recommendation. In implementing the recommendation, care should be taken to insure that the average is expressed in inflation-adjusted

dollars. For example, if the inflation rate is 10 percent, then a payment of $100 last year is equivalent to a payment of $110 today. Thus, past income payments should be inflated before being averaged with current income.

The Last Reform

If all short-term and long-term reforms were implemented, the measure of ability to pay would still suffer from a serious omission—the result of not expressing deductions and allowances used in need analysis in terms of a negative annuity income equivalent. The last reform would require that future allowances—such as living, tax, and retirement—be projected over the number of years used to compute annuity income. Then, the discounted present value of this stream of allowances would be calculated according to the procedure presented in Appendix C. Finally, the discounted present value would be converted to a negative annuity income equivalent which would be deducted from total annuity income to yield net annuity income. Net annuity income is, therefore, the basic measure of ability to pay.

The conversion of future allowances to a negative annuity income equivalent will increase the equity of such allowances. Consider, for example, the presently used living allowance, which ignores the age of dependents. It causes an inequity, because a family with younger dependents has a longer lasting financial obligation than a family with older dependents; the present deduction does not recognize this difference. The negative annuity income equivalent would take account of such differences.

Problems with the Annuity Income Measure

Other than the obvious practical problem of collecting and processing the additional data required by the annuity income measure, there are two other problems which are perhaps less obvious but more important. The first problem arises because annuity income may be significantly greater than actual income for many families, causing them to borrow more, and more frequently, than they do under the present system. The second problem is that much of the data required by the annuity income measure is not easily verified, a situation which may invite dishonest reporting by parents. Let us consider these problems in more detail.

We have seen that annuity income is a measure of a family's long-run income which includes a component of liquidated wealth. This means that annuity income will generally tend to exceed actual income even in normal times. In bad times—when actual income is far below average due to a temporary layoff, a crop failure, a natural disaster, or some other calamity—the discrepancy between annuity income and actual income will be very large. During such times families will be forced either to borrow or

to liquidate assets in order to meet their expected contributions, because the annuity income measure, unlike the UM measure, is relatively insensitive to changes in actual income.

This situation is problematic only if capital markets fail to provide sufficient loan funds to parents who wish to borrow. Generally, parents can pledge their assets as collateral for needed loans. However, not all wealth is equally accepted by lenders. Human capital, for example, is especially difficult to borrow against because its ownership cannot be transferred. Other forms of wealth such as high risk assets, some real estate, consumer durables, and collector's items may also be difficult to borrow against. Parents who do manage to borrow against these assets may do so on unfavorable terms: interest rates may be above market rates, amounts loaned may be inadequate, or the term of the loan may be too short.[8] This suggests that the use of annuity income as a measure of ability to pay must be accompanied by adequate guarantees to parents that they can borrow to meet their expected contributions. One step towards providing these guarantees would be a change in the regulations of the Guaranteed Loan Program (GLP) giving parents the right to borrow the full amount of the expected contribution.[9]

The need to provide for expanded parental borrowing is likely to arise only if annuity income from human capital is included in the new measure of ability to pay, something which is not proposed in the short term reforms recommended earlier. Ultimately, however, when annuity income from human capital is included, the question of adequate loan funds for parents should be fully explored.

Another possible problem with the annuity income measure is that parents may be dishonest in reporting the value of assets such as items 6, 10, 11, 12 and 14 (royalties, policies, annuities, trusts, and consumer durables). Certainly, the values which they report would be impossible to verify, but so, for example, are the values of stocks, bonds, and real estate which are now collected on need analysis documents.

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[8]Often individuals may borrow against human capital if they simultaneously purchase a life insurance policy payable to the lender in the amount of the loan. The premium paid may be regarded as a hike in the normal interest rate. Even in these cases the lender is not protected against loss of earnings due to illness, unemployment, or individual sloth.

[9]It is interesting that a change in GLP regulations in 1972 now makes it possible for the parents of a dependent student to borrow indirectly through the student. The regulation gives the student the opportunity to borrow up to the full amount of the PC whenever the parents are unwilling or unable to pay it. Thus, parents who wish to borrow from the subsidized GLP could simply refuse to pay the PC but promise to repay the loan for their child. The practice is deceptive, but there is little doubt that many parents would take advantage of the loophole if they knew of its existence.

There are three other arguments in favor of expanding the asset data base even though the items are not easily verifiable. First, IRS experience with tax audits suggests that most families are fundamentally honest in reporting financial information. Second, parents respond favorably to the threat of criminal liability which they face if they falsify financial information on the Family Financial Statement (FFS). Third, the copy of IRS Form 1040 which parents must supply to those processing the FFS provides a check on families whose wealth to income ratio falls outside reasonable bounds. To be sure, these arguments are not entirely persuasive, but they suggest that the problem of dishonest reporting may be less of a concern than one might otherwise assume. Nevertheless, it would obviously be desirable to conduct a feasibility study of the annuity income approach in order to check the accuracy of all parent-reported information on the value of family-owned assets.

THE ANNUITY INCOME APPROACH VERSUS THE PRESENT VALUE OF TOTAL RESOURCES APPROACH

In 1971 the Cartter Panel recommended the consideration of a new approach to need analysis known as the Present Value of Total Resources (PVTR) approach.[10] The PVTR approach recommended that future earnings and living costs be taken into account in the assessment of parents' ability to pay.[11] The essential difference between the PVTR approach and an annuity income approach is that PVTR is a stock measure of ability to pay and annuity income is a flow measure. PVTR is conceptually identical to total wealth as delineated in Table 1. Thus, the annuity income approach recommended in this paper is a variant of the PVTR approach. Because the annuity income approach is so closely related to the PVTR approach, it is perhaps worth considering briefly the factors and circumstances which led to the rejection of the PVTR approach.

There are six essential reasons why the PVTR approach fell on deaf ears when it was first recommended in 1971. First, the political climate strongly favored retention of the established methodology, because pending federal legislation to create the BEOG program was predicated on the use of this methodology. Second, the basis for projecting lifetime earnings had not been sufficiently refined to favor adoption of a PVTR approach. Future earnings profiles were based on 1960 census data and no adjustment for

[10]Cartter, *New Approaches*.

[11]See Friedman, *A Theory of the Consumption Function*, p. 55, for a discussion of this recommendation.

economic growth was included; in addition, the problem of how to project the earnings of working mothers was left unsolved. Third, instability in financial markets owing to an unforeseen inflation caused concern over the possibility of forecasting (and discounting) future earnings and living costs. Fourth, the ability of capital markets to provide loan funds to parents with a high ratio of PVTR to actual income was questioned. Fifth, the empirical consequences of switching to a PVTR approach were largely unexplored.[12] Concern ranged from a belief that the PVTR measure would have little actual effect on parents' expected contributions, to a fear that it would drastically alter the distribution of families according to ability to pay. Finally, there was concern that the theory behind the PVTR approach might seem inexplicable, and hence unacceptable, to aid administrators and parents.

Are these objections likely to cause rejection of the annuity income approach? Let us consider the objections one by one. First, it seems clear that the political climate has changed since 1971. Public policy on student financial aid is now directed toward standardization, consolidation, modification, and perfection of the present approach. Now that federal programs have been created and expanded, the climate seems to favor some experimentation and testing of alternative approaches. Thus the political climate appears to be moderately receptive to a new approach.

Concerning the ability to predict future earnings, there is little doubt that improvements made possible by 1970 census data and by empirically estimated earnings functions make projection of lifetime earnings profiles based on individual worker characteristics more feasible now than in 1971. Yet problems remain. The estimated effect of such individual characteristics as age, race, sex, experience, ability, or occupation on earnings shows considerable variation among empirical models, owing to differences in data and model specification. But projected earnings profiles do not need to adjust for all differences in individual characteristics that affect earnings. Indeed, it is reasonable to believe that earnings profiles based on census data would be adequate in most cases. The critical question is not whether errors in predicting future earnings can be eliminated; they cannot. The question is whether such errors are less distorting than the errors which occur in the present UM model, where differences in the future earnings prospects of individuals are completely ignored. When the issue is viewed in this light, the case for an annuity income approach or a PVTR approach is more compelling.

The issue of whether inflation would seriously impede efforts to forecast future earnings is not really an issue at all, because inflation causes both

[12]The study by Goggin cited above addressed this question directly.

an increase in expected future earnings (or receipts) and a corresponding increase in interest rates. The present value of future earnings is unaffected by inflation: both the PVTR measure of ability to pay, or its flow equivalent, annuity income, are essentially inflation neutral.

The question concerning the ability of capital markets to provide an adequate supply of loan funds to parents under a PVTR or annuity income approach has already been discussed. However, the reader should note that even under the present UM system, the adequacy of capital markets is a concern in all cases where the contribution from assets is high relative to the contribution from income.

The empirical consequences of switching to a PVTR approach or an annuity income approach should be investigated by using the data processing simulation model created by the Keppel Task Force to test various changes in the measure of ability to pay.[13]

The two alternative approaches seem no more complicated than the present UM approach. Indeed, they seem conceptually simpler. The actual implementation of either alternative would require aid administrators to learn to use some new tables, but little else would be involved. At worst, parents and aid administrators would be indifferent to the new approach; at best, they would favor it. As financial aid administrators increasingly understood the new approach, they would accept it.

CONCLUSIONS

This report has argued for adoption of an annuity income measure of parents' ability to pay, and against continuation of the consensus measure developed by the Keppel Task Force (the UM measure). The new measure could be implemented in two stages. In the first stage, four changes to the UM measure would be introduced. None of these changes would require the collection or analysis of additional data; they should be introduced as a package.

In the second stage, the UM should be made more comprehensive by expanding the list of assets included in the resource base. The values of many of these assets will have to be estimated by calculating the discounted present value of current and projected future income from each asset. In addition, the allowances against income—living, tax, retirement—should be converted to a negative asset value by calculating

[13]The capabilities of this simulation model are described on page 24 of the Keppel Task Force Report.

the discounted present value of current and projected future allowances. Only after both stages have been implemented will the annuity income approach be complete, internally consistent, and equitable.

Because the implementation of the second stage will require the collection of additional data from parents, a feasibility study should be initiated to determine the time and resource cost of implementing the second stage. Although the cost may at first seem high, this report has demonstrated that the cost of not adopting an annuity income approach is a continuation of an assessment method which is haphazard, inequitable, and logically indefensible.

APPENDIX A

A Summary of the Uniform Methodology

Dependent Students

Conceptually, the Uniform Methodology (hereafter abbreviated UM) is no different from its ACT and CSS forerunners. Its basic premises are set forth in the Keppel Task Force Report.

> The underlying principle of the proposed national standard is that parents have an obligation to finance the education of their children to the extent that they are able. In analyzing the family's financial strength, both income and assets are considered to provide the most complete index of the family's ability to pay for post-secondary education. Another major assumption of the proposed national standard is that family size and expenses must be considered in order to measure the true ability of the family to contribute to educational costs. So, too, must such other factors that will alter a family's financial strength.[14]

Although the UM recognizes and provides different treatment for students who are financially self-supporting, the primary focus in the current system is on the dependent student.

In evaluating the financial circumstances of a dependent student's family, the UM ignores the past financial circumstances of the family. Its justification for this approach is explained in the Keppel Task Force Report:

> Another general assumption of the proposed national standard is that the family must be accepted in their present financial condition. Any system that analyzes financial need must deal first with the objective facts of family financial circumstances. It cannot make distinctions between the frugal poor and the spendthrifty. It cannot distinguish between improvidence and financial tragedy. Families with similar incomes may have dissimilar assets for a variety of reasons. Previous illness, bankruptcy, or unemployment may have depleted the assets of a family. If a family were expected to contribute an amount greater than its *present ability* dictated, the student would be penalized by being forced to find a way to assume the financial burden that could not be met by either parents or existing aid programs.[15]

The UM calculation of a family's expected contribution takes account of the income and net assets of the parents and net assets of the student. The expected contribution of the student is calculated separately from the expected contribution of the parents, although both calculations follow a

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[14] See page 22 of the Keppel Task Force Report.

[15] *Ibid.*, p. 22.

similar approach. In essence, the UM functions as a tax on the resources of the student and the parents. Just as the basic equation in taxation is tax base × tax rate = yield, so the basic equations in the UM are:

adjusted available income (AAI)	×	contribution rate	=	expected parental contribution (PC)	(5)
adjusted student resources (ASR)	×	contribution rate	=	expected student contribution (SC)	(6)

The sum of PC and SC is the expected total family contribution (TFC).

The expected student contribution is calculated as shown in Table 4.

TABLE 4

Calculation of Expected Student Contribution for Dependent Students

1. Expected summer savings ($500-$700)
2. + 100% of veteran's benefits
3. + a percentage of social security benefits
4. + 35% of student's net assets
5. = adjusted student resources
6. × 100% contribution rate
7. = Expected Student Contribution (SC)

In Table 4, the percentage of social security benefits included in line 3 depends upon the level of parents' Adjusted Available Income (AAI); the higher the AAI, the higher the percentage included. The rationale for this approach is that higher income families are more likely than lower income

families to be able to devote a large proportion of social security benefits to meet educational expenses. Aside from this special treatment of social security benefits, the calculation of the student contribution is straightforward, but not inflexible. Individual aid administrators may, for example, choose to expect more (or less) from summer earnings (line 1) or they may choose to take more than 35 percent of the student's net assets (line 4).

For dependent students, the calculation of the PC is the major determinant of the FC. The PC is a more complicated calculation than the SC and is summarized in skeletal form in Table 5.

TABLE 5

Calculation of Expected Parental Contribution for Parents of Dependent Students

1. Total income of both parents or guardians
2. - allowances against income
3. = available income
4. + 12% of Discretionary Net Worth
5. = Adjusted Available Income (AAI)
6. × contribution rate (graduated schedule)
7. = Expected Parental Contribution (PC)

In Table 5, total income of both parents or guardians (line 1) includes wages, salaries, tips and other employee compensation, dividends, interest income, adjustments to income (sick pay, moving expenses, etc.) other taxable income, and non-taxable income for the calendar year preceding the academic year. The allowances against income (line 2) include federal income and social security taxes paid, state and other taxes paid, medical/dental expenses in excess of 3% of Total Income, casualty losses claimed on IRS form 1040, a housekeeping allowance applicable to family units where both parents or guardians work, and a basic living allowance, called the Minimum Standard Allowance, equal to an inflation-adjusted low standard of living for a family in 1967. The Minimum Standard Allowance is a function of family size. There is no

adjustment for place-to-place differences in cost of living. In terms of the taxation analogy, Available Income (line 3) may be viewed as the income portion of the parents' tax base.

The asset portion of the parents' tax base is given by line 4. Discretionary Net Worth includes home equity, other real estate equity, cash assets, the market value of stocks, bonds and other investments (net of debt against these assets), a proportion of parents' equity in farm or business, and an allowance against net assets based on the amount needed to insure a moderate budget standard of living during retirement years. Excluded from discretionary net worth are consumer durables (and consumer debts), assets such as jewelry, gold, silver, rare coin and stamp collections, the cash value of life insurance policies, country club membership stock, patents, copyrights, oil leases, works of art, and some endowment and trust funds. Also excluded from discretionary net worth is any outstanding indebtedness which parents may have incurred in order to meet their PC in previous years.

The UM converts Discretionary Net Worth to an income supplement by multiplying it by a conversion rate of 12 percent. The stated reason for converting Discretionary Net Worth to an income supplement in this manner is given in the Keppel Task Force Report:

> The purpose of the income supplement is to take account of the contribution that discretionary net worth makes to ability to pay for goods and services out of current income. The percentage of discretionary net worth that is assumed to be converted to an annual supplementary income flow is 12 percent. A uniform conversion ratio was chosen because of its ability to recognize changes in the economy. A single conversion rate also has the advantage of understandability, and reflects the present rate of inflation in the economy. The most prevalent assets held by families seeking financial assistance are those composed of homes and real estate equity. Changes in the market value of such holdings from year to year are primarily a function of inflation. Consequently, a conversion rate that approximates what inflation has added as an increment of value appears to be appropriate.[16]

Since this rationale suggests that the conversion rate is tied to the Consumer Price Index, it should be expected to change from year to year.

The sum of the income and asset portion of the tax base is given by line 5. Table 6 presents the graduated contribution rates which are used to convert AAI to the PC.

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[16] *Ibid.*, p. 7, Appendix E.

TABLE 6

Schedule of Contribution Rates

Adjusted Available Income	Taxation Rates
Less than $-3,406	$-750
$-3,406 – +4,280	22%
4,281 – 5,350	$ 942 + 25% of AAI over $4,280
5,351 – 6,420	1,208 + 29% of AAI over 5,350
6,421 – 7,490	1,518 + 34% of AAI over 6,420
7,491 – 8,560	1,882 + 40% of AAI over 7,490
8,561 or more	2,310 + 47% of AAI over 8,560

Adjusted Available Income below $0 is not taxed; in fact, a negative rate is applied to yield a negative contribution. A negative contribution does not directly affect the size of a student's aid award but it does enable aid administrators to rank the students whose parents are unable to pay anything towards additional schooling expenses. The reader should note that the AAI taxation ranges have been broadened from those used in past years to reflect CPI increases.

Whenever a family has more than one student enrolled in a postsecondary program of study, the total PC is increased, but the average PC, or PC per student, is decreased. The following schedule (Table 7) shows the percent of the normal PC (called the multiple sibling rate in the UM) which parents must make for *each* child enrolled.

TABLE 7

Multiple Sibling Rate Schedule

Number of Students Enrolled	Percent of Normal Parental Contribution
1	100%
2	60%
3	45%
4 or more	35%

For example, the preceding schedule is interpreted to mean that a family with two children in college is expected to contribute 120% of the normal (one child) PC.

Independent Students

Under the UM, independent students are treated similarly to dependent students. The tax base of independent students includes the income and net assets of the student and spouse. No contribution is expected from parents, guardians, or relatives, since one of the criteria for assigning independent status to a student is that he or she receive less than $600 in support from their families. In the case of married students, contributions by in-laws of $600 or more do not prevent a student from being classified as independent. However, the contribution is taken into account in the assessment of ability to pay.

There are three noteworthy differences in the UM's treatment of dependent and independent students. First, unlike dependent students, the income reported by the independent student (and spouse) is *expected* income for the coming school year. This is done because the student's income is expected to fall while he is a full time student. In the case of dependent students, the parents' income in the previous year is used because it is subject to verification by the IRS Form 1040.

The second difference between the UM's treatment of independent and dependent students is that the income and net assets of independent students are taxed at a higher rate than the income and net assets of dependent students' parents. Some aid officers choose to tax student net assets at a higher rate than that recommended by the UM. The resulting rate differential can be quite large.

A third difference between the UM's treatment of independent and dependent students is that independent students are not granted a minimum standard allowance or an allowance against income for estimated state and local taxes paid or for housekeeping expenses in the SC calculation itself. Instead, the aid administrator is expected to adjust the student's expense budget for the coming school year to take account of these expenses. If the contribution rate is 100 percent, this difference is essentially cosmetic, because the SC is the same whether the adjustment is viewed as part of the school budget or a separate living allowance.

A summary of the SC calculation for independent students is presented in Table 8 below.

TABLE 8

Calculation of Expected Student Contribution for Independent Students

1. Total income of student and spouse
2. - allowances against income
3. = available income
4. + 35% of discretionary net worth
5. = Adjusted Available Income
6. × 100%
7. = Expected Student Contribution (SC)

The reader should note that the effective marginal tax rate on net assets is the product of the asset conversion rate (35%) in line 4 and the tax rate on AAI in line 6 (100%). The corresponding effective marginal tax rate on the net assets of the parents of dependent students is given by the product of 12% and *t*%, where *t* is the relevant marginal tax rate on AAI (see Table 6). The maximum effective marginal tax rate against parents' net assets is 12% × 47% = 5.64%, less than one sixth the rate on the net assets of independent students.

APPENDIX B

Derivation of A_n

The income stream A_n generated by \$1 worth of assets at a given interest rate i must satisfy the following equation:[17]

$$\$1 = \frac{A_n}{(1+i)} + \frac{A_n}{(1+i)^2} + \ldots + \frac{A_n}{(1+i)^n} .$$

Let $Z = (1 + i)^{-1}$. Then

$$\$1 = A_n[Z + Z^2 + \ldots + Z^n] .$$

Adding and subtracting A_n and rearranging terms,

$$\$1 = A_n[1 + Z + Z^2 + \ldots + Z^{n-1}] - A_n + A_nZ^n .$$

Replacing the finite geometric series in the parentheses with its solution,

$$\$1 = A_n\left[\frac{1 - Z^n}{1 - Z}\right] - A_n + A_nZ^n .$$

Solving for A_n

$$A_n = \frac{1}{\left[\frac{1 - Z^n}{1 - Z}\right] - 1 + Z^n} .$$

Simplifying,

$$A_n = \frac{1 - Z}{Z(1 - Z^n)} .$$

Substituting $(1 + i)^{-1}$ for Z yields the final result:

$$A_n = i[1 - (1 + i)^{-n}]^{-1} .$$

[17]This derivation is presented in Goggin, *Measurement of Economic Well-Being*, page 24.

APPENDIX C

The Meaning and Calculation of Discounted Present Value

This appendix explains the steps involved in finding the value of wealth when no organized market for its exchange exists. The most important type of wealth in this category is human capital. However, entitlements to future payments such as alimony, welfare benefits, social security payments, etc., which cannot be bought or sold are also examples of this kind of wealth.

The value of wealth, whether organized markets exist or not, is always related to the stream of future receipts expected by the owner over the life of the asset. The value is not simply the sum of these receipts, because the receipt of a dollar in the distant future is always worth less than the receipt of a dollar in the more immediate future. This is because interest can be earned on the receipt of the dollar in the more immediate future which cannot be earned on later dollar receipts. The procedure used to measure the present value of future payments is called discounting.

To understand discounting, one must understand the compound interest rule, because discounting is the reverse operation of compounding. Let us review the compound interest rule. Suppose a man invests $100 at an interest rate of 10 percent for three years. What amount will he receive three years hence if he allows his interest earnings to accumulate until the end of the third year? Table 9 summarizes the calculations required to answer this question.

TABLE 9

Summary of Compound Interest Calculations

Principal (P_0) = $100 Interest Rate ($i$) = .10 Number of Years (n) = 3

Year t =	Value of Amount Invested at the End of Year t: In Numerical Terms	In Algebraic Terms
0	$100	P_0
1	$100 + $100(.10) = $100(1 + .10) = $110	$P_0 + P_0(i) = P_0(1 + i) = P_1$
2	$110 + $110(.10) = $110(1 + .10) = $121	$P_1 + P_1(i) = P_1(1 + i) = P_0(1 + i)(1 + i) = P_0(1 + i)^2 = P_2$
3	$121 + $121(.10) = $121(1 + .10) = $132.10	$P_2 + P_2(i) = P_2(1 + i) = P_0(1 + i)^2 (1 + i) = P_0(1 + i)^3 = P_3$

At the end of the first year, the initial amount invested (P_0 = \$100) has grown to P_1 = \$110. At the end of the second year, this amount has grown by an amount equal to the interest earnings on \$110 (P_2 = \$110 + 110(.10) = \$121). Finally, at the end of the third year, the second period amount will have grown by an amount equal to the interest earnings on \$121.

Table 1 shows the algebraic expression for the amount at the end of each year. Thus, at the end of year 1 we have

$$P_1 = P_0(1 + 1)$$

and at the end of years 2 and 3 we have

$$P_2 = P_0(1 = i)^2$$

$$P_3 = P_0(1 + i)^3$$

Finally, at the end of n years we have by simple extension of the results above

$$P_n = P_0(1 + i)^n \qquad (7)$$

The latter expression summarizes the compound interest rule. It shows that an investment of P_0 dollars today at a rate of return of i percent per year will attain a value of P_n after n years.

Equation (7) may be used to answer another question. Suppose one wished to know the present value of the receipt of P_n dollars n years from now. That is, if the person who is entitled to receive P_n dollars in n years were able to sell the entitlement, how much would a buyer be willing to pay? Algebraic manipulation of equation (1) shows that this value is given by:

$$P_0 = P_n \cdot \frac{1}{(1 + i)^n} \qquad (8)$$

To use the example presented in Table 9, the promised receipt of \$132.10 three years hence is only worth \$100 today, because \$100 today could be invested at 10 percent compounded annually to yield \$132.10 after three years. Thus the value today of dollars to be received tomorrow must be discounted. The factor by which future dollars are to be discounted is given by the expression $1/(1+i)^n$, which is the second term on the right hand side of equation (8). This expression is called the discount factor. The discount rate is the term $1/1+i$.

The discount factor is a positive number between zero and one which decreases as n, the number of years into the future, increases. This means that the present value of \$100 received 2 years hence is higher than the present value of \$100 received 10 years hence. If n is very large the

discount factor is very small. This means that dollar receipts scheduled far into the future will have a highly discounted, perhaps near zero, present value. To distinguish it from the discount factor, the reader should note that the discount rate is a constant. Its value is determined by i—the rate of return on investment.

These concepts may be applied to the problem of converting a stream of future payments to a single value, which is the discounted present value of these future payments. It represents the single cash payment which a person could receive if he or she were able to sell an entitlement to future payments in an organized market. For example, consider the way in which a person would calculate the discounted present value of his or her future lifetime earnings, that is, the value of his or her human capital. Let P_1 be the expected earnings one year hence; P_2 the expected earnings two years hence; and P_n the expected earnings n years hence, where n is the number of years to retirement. The discounted present value of the future lifetime earnings stream is simply the sum of the present values of each P taken separately. Thus the discounted present value of future earnings is given by the expression

$$\text{DPV} = \frac{P_1}{1+i} + \frac{P_2}{(1+i)^2} + \frac{P_3}{(1+i)^3} + \cdots + \frac{P_n}{(1+i)^n} \qquad (9)$$

Equation (9) suggests that any stream of future payments lasting n years can be converted to a single value, if the rate of interest on equally risky bonds which mature in n years is known. The discounted present value is the best approximation to the current market value of the stream of payments, even though no organized market for the assets yielding the stream of payments actually exists. Equation (9) may be used to determine the discounted present value of a stream of alimony payments, child support payments, life insurance payments, or transfer payments. If payments are made monthly, equation (9) may be modified by expressing n and i in monthly terms.